Journal of Research on the Lepidoptera 28(4):297-309,1989(91)

An unrecognized, now extinct, Los Angeles area butterfly (Lycaenidae)

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Abstract. *Philotes sonorensis* has been regarded as a geographically invariant species. This historic viewpoint is corrected and several geographic variants and patterns of variation are described. A new subspecies, *P. sonorensis extinctis,* is named. The subspecies became extinct in 1967 consequent to an engineering program for water diversion. The relationship of *P. s. extinctis* and parapatric *P. s. sonorensis* are discussed.

Introduction

California not only leads the nation as the trendsetter of fashion, the capitol of entertainment, and the model of buoyant lifestyle, but also as the exterminator of species, including butterflies. "Species" is used here in the context of the federal Endangered Species Act which for invertebrates includes subspecies. Extinction means globally lost, versus extirpation, which refers to extinction in only part of the range.

The first recorded North American butterfly extinction was *Cercyonis sthenele sthenele*, last collected in 1880, followed by *Glaucopsyche lygdamus xerces* in 1943-44. Both were victims of land conversion of the San Francisco sand dunes, dunes which now underlie about half the area of the city and which today are scarcely recognizable. Loss of the Xerces blue was especially unfortunate as its populations were a highly polymorphic complex ranging from the spectacular *xerces* phenotype to that of the surrounding parapatric and widespread subspecies *incognita*. The pattern of variation may have been an ecologic/genetic parallel to the situation described by this paper. In 1958 *Parnassius clodius strohbeeni* was last seen in the Santa Cruz mountains, a possible victim of overcollecting. The next known extinction was the unexplained disappearance of *Argynnis (Speyeria) adiaste atossa* around 1960 (Emmel and Emmel, 1973). This fritillary was formerly abundant in the Tejon Mountains near Los Angeles. After 1983 *Glaucopsyche lygdamus palosverdesensis* of suburban Los Angeles was no longer seen, in spite of intensive attempts by a squad of experienced collectors under the able leadership of Jess Morton (Mattoni, unpublished). The species was lost to a combination of overcollecting, poor weather and habitat fragmentation. The time of the last flight of an undescribed subspecies of *Plebejus saepiolus* in the Big Pine area of the San Gabriel mountains was 1985 (Emmel, pers. comm.). At least two additional species are in imminent danger of extinction: *Argynnis (Speyeria) adiaste clemencei* and *Euphydryas editha quino* (=*wrightii* of authors)(Allen, Brown, Ballmer

& Mattoni, unpublished data). Although neither were seen for several years after 1986, the fritillary was widespread with only a single population of the checkerspot reported in 1990. These last observations are hardly encouraging. Several other species are probably not too far behind. These events were so rapid that no timely help was provided by the listing process under the Endangered Species Act. Between widespread political attacks to weaken the Act and serious understaffing of agencies, the future for biodiversity is indeed bleak.

The list can now be expanded by a previously unreported subspecies which became extinct in 1967. The event passed unnoticed because of an unrecognized systematic situation I will in part rectify with this paper. Failure to formally notice significant geographic variation in *Philotes sonorensis* was perhaps a function of later authors assuming authority of earlier authors who did not notice consistent patterns of variation other than naming one form and one aberration. The species clearly stands apart from all Scolitantidine blues, without apparent sister species, in the monotypic genus *Philotes* . The entire species is almost completely confined to the California Floristic Province (described by Raven, 1988), a trait shared with only eight other butterflies. This isolation, combined with a striking appearance, may have biased observers into overlooking complex variations. However, Langston (1963) broke with tradition and cited a substantial and consistently different appearance of specimens from central coastal California when compared with those from the south, figuring females of each. Langston later (1972) referred to macule and aurora variation in northern California colonies. From his thesis on *Philotes* Shields (1973) noted that Los Angeles County specimens are larger with the females more boldly marked. He found no geographic variation in valve teeth number in males, cited the Mattoni and Seiger (1963) report of intrapopulation variation of UFW postmedian macule number in populations of the San Gabriel Canyon wash, and let the matter rest. During the same time period Fred Thorne (pers. comm.) provided specimens and advised that San Diego County populations from the desert (Sentenac canyon area) and coast (Pt. Loma/La Jolla) were sufficiently distinct to warrant subspecific status. Coastal San Diego County populations no longer exist, although there may be remnants along the northern Baja California coast (Brown and Faulkner, pers. comm.). The species distribution is shown in figure 1.

Inspection of series of specimens from throughout the range shows several distinct sets of wing pattern types which beg further systematic study. With escalating destruction of natural habitat such study should be undertaken soon. While preparing a guide for identification and conservation biology of butterflies of the Los Angeles area (Mattoni, 1990), it was necessary to formally name the unique population described below:

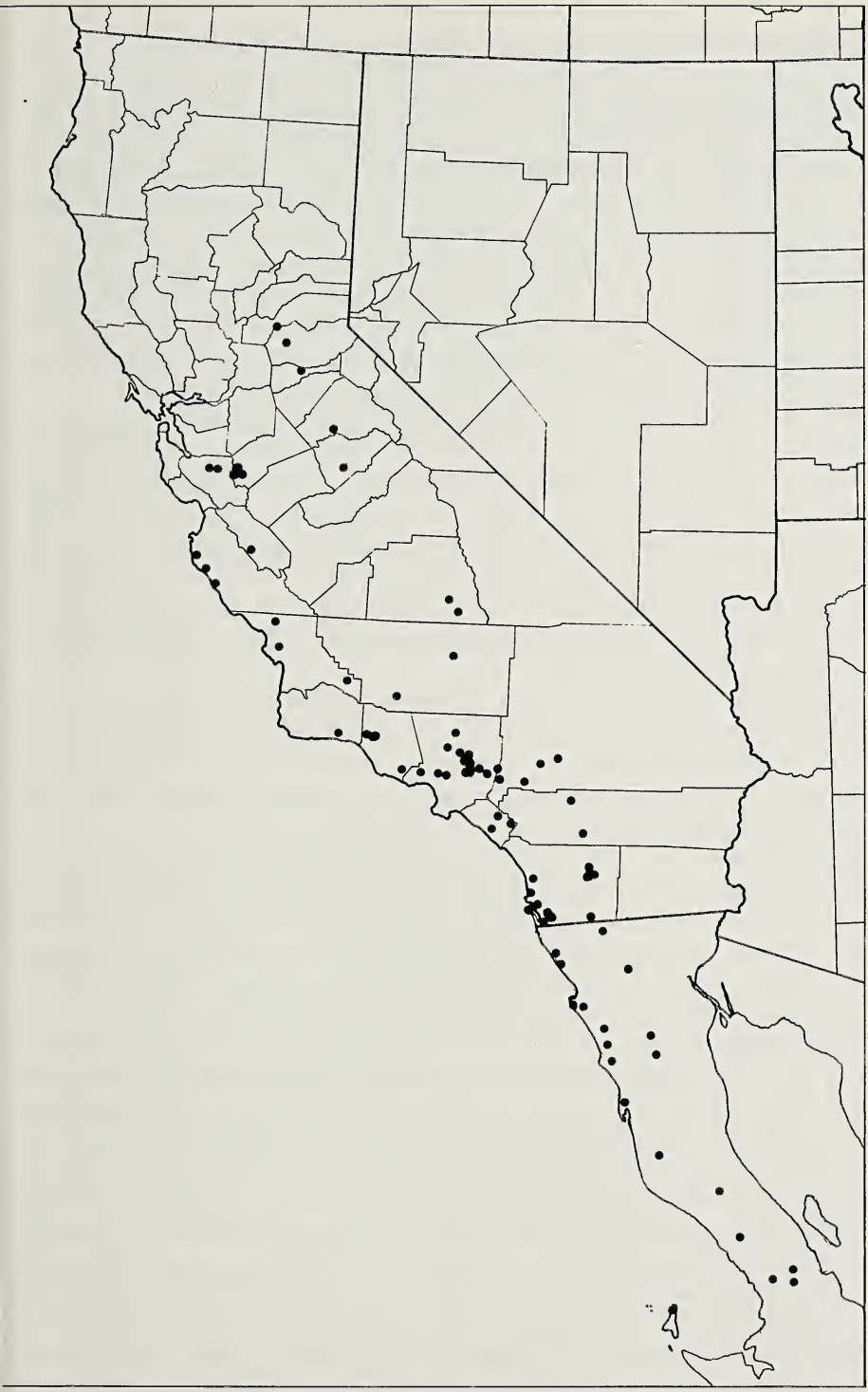

Fig. 1. Distribution map of *Philotes sonorensis*. Data after Shields 1973 with a few recent records.

Philotes sonorensis extinctis Mattoni **new subspecies**

Males. Upperside. Cyanic overlay as in nominotypical species. *Forewing*: postmedian macule number vary in number from none to five, with frequency distribution given in table 1; holotype with four. *Hindwing* as in nominotypical species. **Underside**. Ground medium grey-brown. Fringes well distinguished at all veins. *Forewing*. Macule pattern as in nominotypical species. *Hindwing*. Median space between sub-basal and postmedian macule usually lightened against ground by whitish suffusion, postmedian space darker grey than ground with submarginal macule absent and with submarginal space light grey usually most strongly marked in M_3, Cu_1 and Cu_2. Marginal macules faint.
Females. Upperside. Cyanic overlay similar to nominotypical species, but slightly and uniformly darker due to a higher proportion of melanic scales. Marginal band wider and macules 10 to 30% larger on average than other populations presenting a darker overall aspect. *Forewing*. Postmedian macule number in interspaces Cu_1 and Cu_2 vary from 0 to 3. *Hindwing*. Macules and orange aurora larger than other populations, entire spaces anterior to Rs with melanin suffusion, again presenting a darker overall appearance than nominotypical species. **Underside.** In all aspects similar to males.
Types: All specimens taken in the upper San Gabriel wash from February through April over a period of 1922-1967, after which they were extinct. Older specimens are variously labelled San Gabriel Canyon, San Gabriel Canyon wash, Fish Canyon, and Azusa. Holotype male and allotype female III 24 1963, R. H. T. Mattoni leg.
Type disposition: The holotype and allotype will be placed in the Smithsonian Institution. 115 paratypes will remain in the author's collection until further systematic issues are resolved and will then be placed in an appropriate institution. The Los Angeles County Museum of Natural History has 255 paratypes. All specimens figured will be deposited in the Los Angeles County Museum of Natural History.
Etymology: The subspecies name calls attention to the fate of the taxon. I suggest the common name **Human Folly Blue** because the extinction was due to a short term engineering fix without recognition of long range environmental impacts. The U. S. Army Corps of Engineers destroyed the habitat to provide a spreading basin for ground water recharge. Two consequent ironies of the action are that the Corps of Engineers would today be prevented from such action by its own mandate to preserve riparian habitat and that the groundwater basin being recharged is now contaminated with chlorinated organic chemicals. This historical lesson of environmental tinkering appears forever condemned to repetition.
Nomenclature and Synonymy: C. and R. Felder (1865. Reise Novara 2:281 & plate 35 figs. 3,4) named *Lycaena sonorensis* with the habitat designation of Sonora (Lorquin). The Felder (Lorquin) "Sonora" type locality issue was discussed by Brown (1967). Both O. Shields and J.

	Males									Females						
	X	A	B	C	D	G	I	CM	Sample size	3	2	1	0	CM	Sample size	Total
San Gabriel Mts. Wash																
2 (1955)	.005	.60	.13	.07	.19	.01	.005		592	.41	.22	.22	.15		203	795
2 (1956)	.005	.55	.13	.07	.24	.005	.003	.001	733	.39	.16	.16	.28	.008	237	970
4 (1963)		.49			.33				94							
6 Bridge		.50	.18	.05	.27				22	.29	.15	.57			7	29
Total, Wash	.005	.57	.12	.06	.23	.007	.003	.001	1424	.40	.19	.19	.22	.004	447	1871
East Fork	.61	.31			.08				13			1.00			1	14
Coldbrook	.45	.45		.05	.05				20	.17		.67	.17		6	26
Total, mountains	.52	.39		.03	.06				33	.14		.71	.14		7	40
San Diego coast	.31	.57	.04		.08				26	.55	.11	.33			9	35
San Diego desert	.41	.41		.13	.03				39		.12	.82	.06		17	56
Santa Barbara Co.	.13	.72		.09	.03		.03		32	.20		.80			10	42
Atascadero	.08	.46	.21	.04	.21				24						0	24
Alum Rock Park	.32	.45	.19		.03				31		.06	.75	.19		16	47
Del Puerto	.09	.86			.05				22						0	22
Chili Bar	.18	.48	.03	.27	.03				33		.43	.43	.14		7	40

Table 1. Frequency of forewing postmedian macule classes in different geographic populations of *Philotes sonorensis*. Classes are described in text and shown in figure 2. The samples are grouped into the San Gabriel Mountains, which had two distinct phenotypic class populations; the San Diego coast and desert, each with a distinctpopulation; the central California coast; and Chili Bar in the northern Sierra Nevada Mountains. When total sample of female set is less than 6, the class frequency is not scored, but the class size is given (East Fork only). For sample site 4, 1963, only data for classes A and D are available.

Emmel provided additional information (in litt.). A population from "environs de Los Angeles" was named *L. regia* by Boiduval (1869. Ann. Ent. Soc. Belgique 12: 46) but was subsequently synonymized with *L. sonorensis* by Reakirt (1878. Butterflies and Moths of North America). Comparison of published figures indicate the Boisduval specimens differ phenotypically from those of the Felders. Both Felder and Boisduval material clearly was collected by Lorquin, but the exact origin of any of the specimens remains obscure. Two pairs of Boisduval specimens labelled "type" are in the USNM (Oberthur collection). The two well worn Felders syntypes are males in the BM(NH). Photographs of a pair of Boisduval syntypes appear similar to *extinctis*, with the dark postmedian space. The other pair is marked as the widespread montane populations. The specimen figured by the Felders is not *extinctis*, but appears similar the nearby populations and lighter Boisduval syntypes.

Reconstructing the Lorquin type localities revealed the specimens were likely taken in 1852 when Lorquin travelled around Los Angeles and also in San Diego. During travel near Los Angeles he took *Glaucopsyche piasus sagittigera*, most likely near the Verdugo Hills and may well have collected *L. sonorensis* at same time. Neither named taxa conforms to *extinctis*. A type locality must be designated when the species is thoroughly studied.

Diagnosis

The San Gabriel wash population was distinct and deserves special recognition for its combination of three characteristics: 1) postmedian macule pattern frequency and dimorphism of a unique form, 2) complex difference in the underside ground and maculation pattern in almost all individuals, 3) very high population densities.

1). POSTMEDIAN MACULE PATTERN FREQUENCY AND DIMORPHISM OF THE UNIQUE FORM "COMSTOCKI"

The postmedian macule patterns were arbitrarily designated by letter for males and number for females and are illustrated in figure 2. The male classes X, A, B, C, D, G, and I represent a decreasing macule number in interspaces Rs to Cu 1 ranging from 5 to 0 macules. Classes B and C both have 3 macules but different positions. The female classes range from 3 to 0 macules within interspaces Cu 1 and Cu 2.

The form "comstocki" (CM) is illustrated in figure 2, second specimen in row 3 and Mattoni (1964: specimen 15). On the upperside, male CM are indistinguishable from "normal" specimens that are without macules (pattern class I), but the underside is obviously distinct. The ground is entirely the darker grey that is restricted to the postmedian interspace in the normal. The hindwing macules are absent and the forewing postmedian macules are aggregated into a single discoidal macule. Female CM undersides are as the male, but the upperside forewing macules are distributed as on the underside. The CM character state was

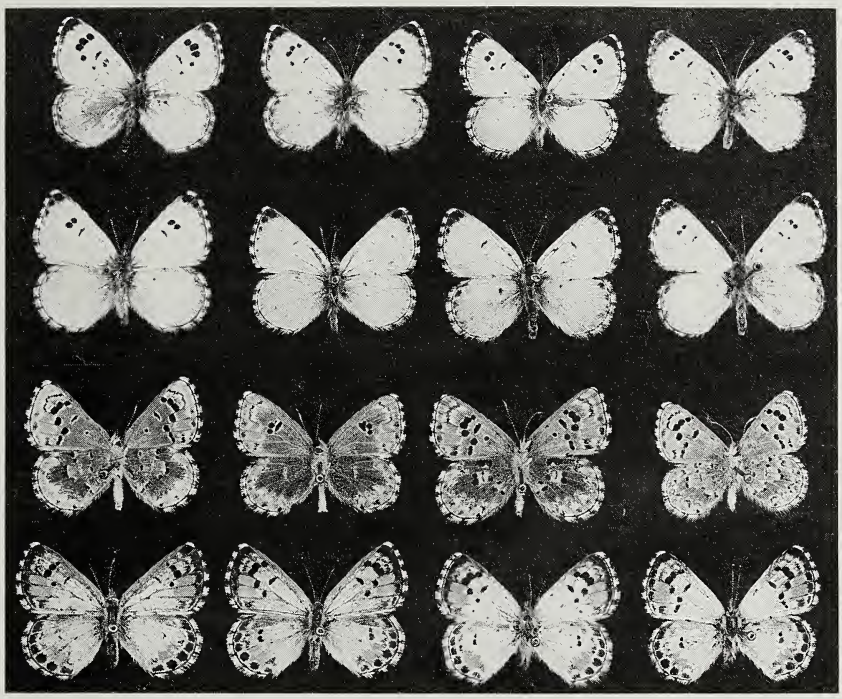

Fig. 2. Specimens of *P. sonorensis extinctis* from San Gabriel Canyon wash showing classes of upperside pattern and underside variation. Left to right. Row 1, males: X, A, B, C; row 2, males: D, G, I (or CM, difference in underside), asymmetric, D on left, B on right; Row 3, undersides: wild type, CM ("comstocki"), D/CM, upper San Gabriel canyon; row 4, females: 0, 1, 2, 3. See text for further explanation. Unless otherwise stated all specimens in figures leg. R. Mattoni.

probably controlled by a recessive gene that modified melanin deposition at a critical stage during pigment formation in the pupa. The hypothesis that the CM variant was environmentally induced cannot be discarded, yet failure to observe CM in any other populations and its relatively high frequency at San Gabriel strongly supports a genetic explanation. Recessiveness is inferred from a report of all wild type progeny from a CM female by an early collector, but both report and undocumented data are hearsay.

Following the conclusion of their fieldwork, Mattoni and Seiger (1963) noted an additional distinct variant class: rare males with state D upperside macule pattern and females with a 0 macule pattern, but with a underside primary postmedian macule series less than half the distance from the discoidal macule to the distal wing margin. This variant (D/CM) is illustrated by specimen 11 in figure 2, 13 in figure 3, and specimens 13, 14, and 20 in Mattoni (1964). Our hypothesis was that this variant represented the heterozygote of CM, as its frequency approxi-

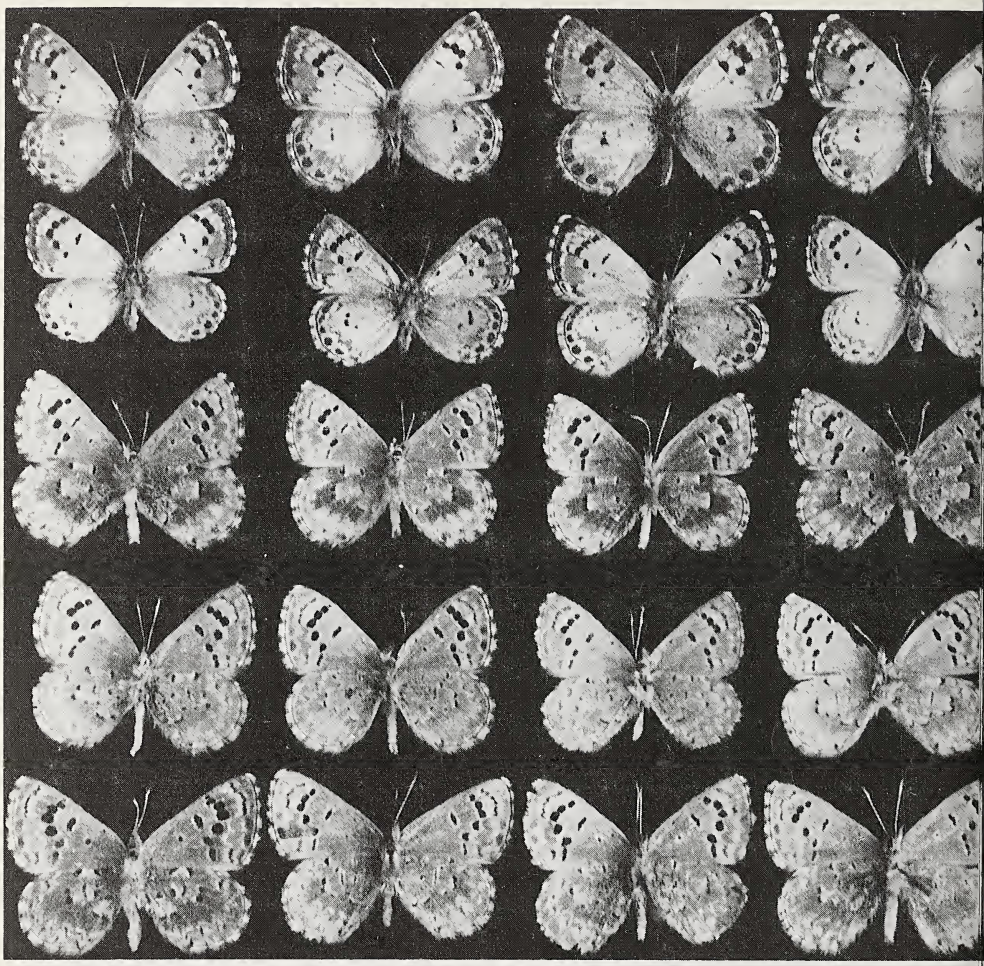

Fig. 3. Variation in upperside patterns in females and underside patterns comparing specimens from lower San Gabriel canyon wash (*extinctis*) and upper San Gabriel canyon (*sonorensis*). Row 1, females, wash. Row 2, females, upper canyon at Coldbrook ranger station. Row 3, undersides, wash. Row 4, undersides, Coldbrook ranger station. Row 5, undersides, fire road or site 7, intermediates, see text.

mated the Hardy-Weinberg equilibrium in the small sample we made in 1963. Mattoni (1964) published a color plate illustrating these forms as well as samples from other populations. The legend for this plate is given below, as this information is not elsewhere available.

The frequency of all the postmedian macule classes and CM are given for populations from which more than 20 specimens were available. It should be noted that asymmetry is exceptional. The 14-specimen East Fork sample was included to increase the upper San Gabriel canyon population. Three conclusions can be drawn from these data: wash population (*extinctis*) males had a significantly greater frequency of class D (except Atascadero) and a significantly lower frequency of class X than any other populations, wash females had a higher frequency of class 3

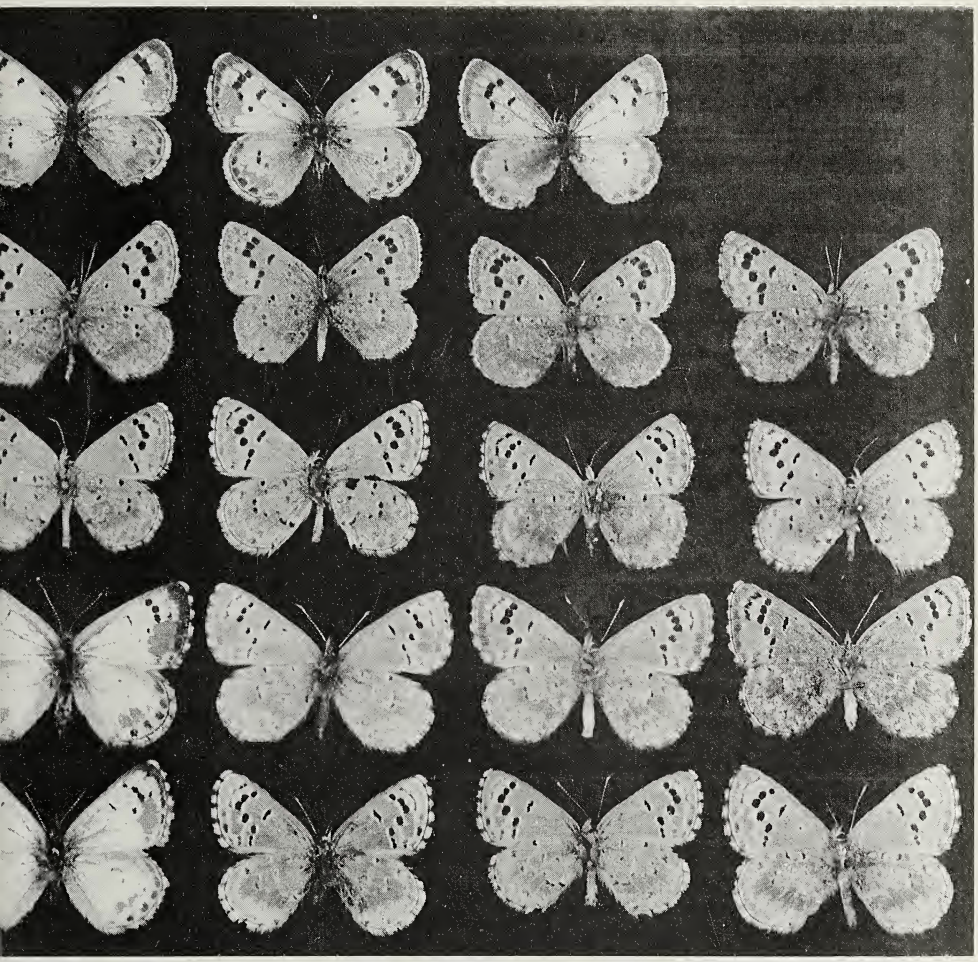

Fig. 4. Specimens representative of different geographic areas. Row 1, females, El Dorado county, Chili Bar, leg. O. Shields. Row 2, undersides, same data as row 1. Row 3, undersides, Santa Clara county, Alum Rock Park, leg. R. Langston. Row 4, female and 3 undersides, San Diego county, Sentenac Canyon, leg. F. Thorne. Row 5, female and 3 undersides, Santa Barbara county, Santa Barbara, leg. R. Denno.

than any population (except San Diego coast, possibly representing a sampling error, but see below), no valid specimen of CM has ever been observed from any but the San Gabriel canyon wash population. Since the extinction of *extinctis*, local collectors mostly take their specimens from other parts of the San Gabriel mountains, usually in Brown's Gulch, located 3 miles north of what was the wash. Form CM has never been seen in spite of a thousand or more takes in the vicinity. A specimen of CM reported by Shields (1973) from Ventura County (Henne, leg.) was apparently a class I specimen in which the underside was not inspected. The Henne collection in the LACM has a Ventura I male with a normal underside.

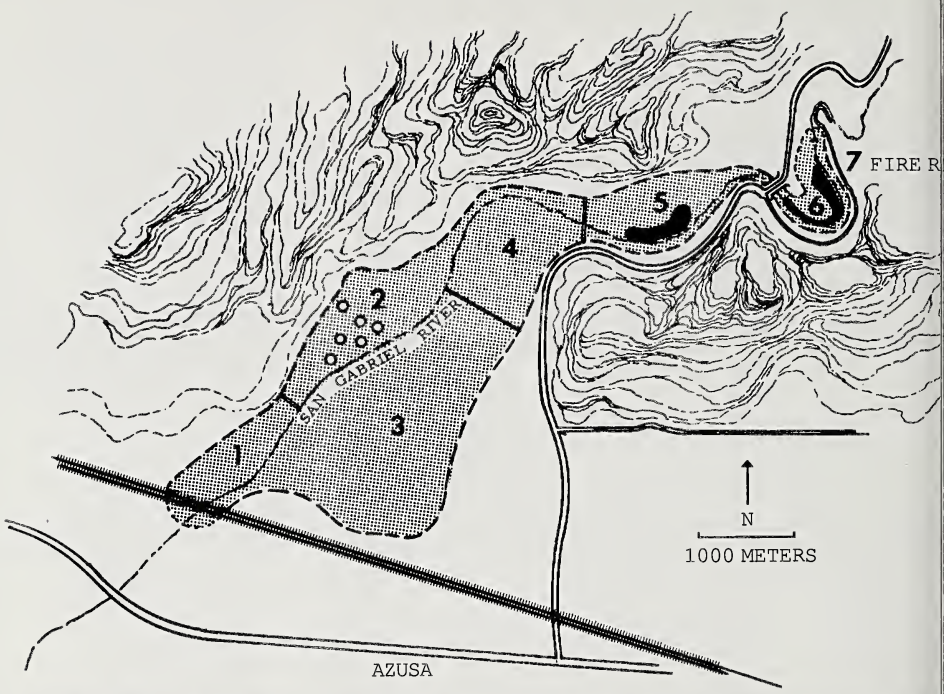

Fig. 5. Map of distribution of *Philotes sonorensis* in the lower San Gabriel wash prior to 1967. Areas in black remained in 1968, although no butterflies remained. These last remnants destroyed in 1980's.

2). THE UNDERSIDE PATTERN COMPLEX

Virtually every specimen from the wash population can be separated from the populations in upper San Gabriel canyon and most other localities by the underside pattern. The character is illustrated in figures 2, 3, and 4 as well as Mattoni (1964). The difference between the wash and upper canyon populations is most striking in figure 3, comparing rows 3 and 4. The border between these character states is abrupt, the limit apparently having been the edge between the wash and the steep slopes marking the beginning of the canyon walls. This border is shown on the map, figure 5. Butterflies taken at this interface are shown in figure 3, row 5. The specimens taken here, which were rare, indicate a zone of intergrades and segregates. Since early 1980 access to the area has been blocked, so status of the species is unknown at the site.

The distinct dark grey postmedian space on the secondaries occurs in coastal San Diego county populations (extirpated, see Mattoni 1964 figure 21) and some other alluvial washes from the south slopes of the San Gabriel mountains. The latter have not been well sampled and today few, if any, remnants of these wash populations are extant.

Samples of underside patterns from other populations are illustrated for comparative purposes. These include desert San Diego county figure

4, row 4 and Mattoni 1964, 29-32), Santa Barbara (figure 4, row 5 and Mattoni 1964, 25-28), Alum Rock Park, Santa Clara county (figure 4, row 3), and Chili Bar, El Dorado county (figure 4, row 2). The Chili Bar population is also singular in that 90% of the sample lacked checkered fringes.

3). HIGH POPULATION DENSITIES

The reason the San Gabriel wash was the long favored locality of collectors of the Human Folly Blue was the extremely high population numbers of the butterfly in the small circumscribed area where it occurred (figure 5). The 1955 and 1956 study of Mattoni and Seiger (1963, and unpublished) indicated total standing populations in those years on the order of tens of thousands in the 8 square kilometer area the population inhabited. During the period beginning with the discovery of the population until its destruction in 1967, collectors could easily take several hundred specimens in a day. No other known population of the species had or has the potential of such yields. Abundance of individuals of the *extinctis* population was unique in terms of high densities in every year for which records are available. The density characteristic was not a function of foodplant density, as many other populations (i.e. Baja California, central California coast) are found in regions where *Dudleya lanceolata* and *D. cymosa* are among the dominants in their plant communities yet the butterfly remains rare.

Rarity has only recently been viewed from the standpoint of relating the characteristics of species that define rareness (Rabinowitz, 1981). Through most of its range *P. sonorensis* is rare in the sense of being constantly sparse yet occurring across several limited habitats. Under all conditions it is distribution limited by the occurrence of its foodplant, usually a colonial and local plant. Because butterflies are all *r*-strategists, excepting possibly the giant *Ornithoptera*, rarity must have an ecological and/or genetic bases. All populations have the potential of rapidly achieving high density, but do so only on occasion. The very dense population of *extinctis* occurring adjacent to, and probably interbreeding with, low density *sonorensis* implies a gap in adaptive characteristics. Populations of the species from the nearby Big and Little Dalton, Santa Anita and Eaton washes occur(red) only in low density and without the diversity of forms found at San Gabriel.

Microgeographic distribution and systematic implications

The wash population distribution as known in 1963 is mapped in figure 5. At that time there was undisturbed wash habitat to the south of the extant population, but no butterflies could be found although foodplant was present. The areas to the east of 3 and west of 1 had been denatured by residential construction. It is unknown if the butterfly ever occurred in these sites. The black overlay denotes undisturbed sites remaining in 1968. Both were scouted in that year without finding specimens, al-

though a few were taken on the fire road, where they must still occur, but is now inaccessible. These last sites were denatured by construction and clearing in about 1980.

Site 7 (fire road) referred to all the steep slope east and north of site 6 and the bridge. The flat wash immediately north of 6 is an orchard. At this point the road was located within a few feet of the river and it was possible to walk about a mile upriver. Although foodplant was present over this entire area, the butterfly was uncommon. Specimens sampled in site 6 were all of the *extinctis* pattern. The sedentary nature of the species (Mattoni and Seiger, 1963 and unpublished; Keller, Mattoni and Seiger, 1966) probably limited movement across the river between sites 6 and 7. To what extent the distinct patterns and characteristics of *sonorensis* and *extinctis* were maintained by selection as opposed to loss by hybridization remains unknown.

Coda

The *Philotes sonorensis sonorensis / extinctis* relationship had the potential of providing a fascinating case for investigating evolutionary biology in sedentary butterflies. The contrast of two adjacent populations with different complex wing patterns, clear-cut polymorphisms, and ecologies presented a singular situation. Destruction of the wash habitat and attendant extinction of *extinctis* co-opted further investigation. Yet at some future time, when human species density is of necessity reduced and constrained by resource limitation, and the San Gabriel river dams no longer function due to siltation, the wash habitat may be revegetated and a population of the butterfly could re-invade the current biological desert. Should curiosity of biological matters survive for future humans, this note may be useful.

Acknowledgements. The original manuscript was substantially rewritten and vastly improved following input and sometimes pungent comment from Mike Collins, John Emmel, Tom Emmel, Merrill Peterson, Barry Prigge, and Oakley Shields. W. D. Field of the Smithsonian Institution generously provided photographs of one pair of the *regia* types. Chris Henne translated the Boisduval description from the French.

Legend for Mattoni (1964). Specimens read left to right. Top five rows, all San Gabriel Canyon wash 1963, Males wing pattern class: 1, C. 2, B. 3, A. 4, X. 5, Female "comstocki" (CM). Males: 6, I. 7, G. 8, D. Females: 9, 3 10, 2. 11, 1. 12, 0. Undersides: 13, D/CM?. 14, D/CM?. 15, CM. 16, Female, darkly marked. Undersides: 17-19 variants of wild type. 20, D/CM?. 21, San Diego, Paradise Valley (Fred Thorne, leg.). 22-24, Upper San Gabriel Canyon, East Fork (Mattoni, leg.) Underside, 22. Female, 23. Male, 24. 25-28, Santa Barbara, (R. F. Denno, leg.). 29-32, San Diego Co., Sentenac Canyon (Fred Thorne, leg.).

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